AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A method of canceling echo signals in a communication system comprising a transmitter that is configured to transmit signals at a predetermined data rate, and a receiver that receives the echo signals, the method comprising:

filtering the transmitted signals to substantially remove frequency components above a cut-off frequency that is equivalent to at least one-half of the predetermined data rate;

reducing the data rate of the filtered signals from the predetermined data rate to a lower data rate, the lower data rate being determined based at least in part on the frequency portion of the transmitter signals that coincide with bandwidth of the echo signals; and

estimating echo signal components based at least in part on the filtered signals.

2. (Original) The method as defined in Claim 1, further comprising reducing the data rate of the estimated echo signal to match the data rate of the receiver.

3. (Original) The method as defined in Claim 1, further comprising subtracting the estimated echo signal from the echo signals.

4. (Original) The method as defined in Claim 3, wherein estimating the echo signal includes responding to an error signal that is based at least in part on the result of subtracting.

5. (Original) The method as defined in Claim 1, further comprising transmitting signals at the predetermined data rate of fs over a downstream channel, and receiving other signals at a data rate of fs/K over an upstream channel, wherein K is a positive integer.

6. (Original) The method as defined in Claim 1, wherein filtering the transmitted signals includes removing frequency components above a cut-off frequency of fs(J/2K), and

wherein fs is the predetermined data rate, K is a positive integer representing the ratio of fs divided by the data rate of the receiver, and J is a positive integer that is less than K.

7. (Original) The method as defined in Claim 1, wherein filtering the transmitted signals includes removing frequency components above a cut-off frequency of at least one-half of the Nyquist frequency of the signal.

8. (Original) The method as defined in Claim 1, wherein reducing the data rate of the filtered signals includes decimating the filtered signals by a factor of K/J, wherein K is a positive integer representing the ratio of the predetermined data rate divided by the data rate of the receiver, and J is a positive integer that is less than K.

9. (Original) The method as defined in Claim 1, wherein estimating the echo signal includes transversally filtering the filtered signals and minimizing the number of filter tap weights.

10. (Original) The method as defined in Claim 1, wherein the communication system further comprises an asymmetric digital subscriber loop (ADSL) system.

11. (Original) A method of canceling echo signals in a communication system comprising a receiver that receives the echo signals at a first data rate, and a transmitter that is configured to transmit signals at a second data rate, the method comprising:

increasing the data rate of the transmitted signals from the second data rate to a higher data rate;

estimating echo signal components based at least in part on the higher data rate signals; and

matching the data rate of the estimated echo signal with the first data rate of the receiver.

12. (Original) The method as defined in Claim 11, further comprising removing frequency components resulting from matching the data rate of the estimated echo signal.

13. (Original) The method as defined in Claim 11, further comprising subtracting the estimated echo signal from the echo signals.

14. (Original) The method as defined in Claim 13, wherein estimating the echo signal includes responding to an error signal that is based at least in part on the result of subtracting.

15. (Original) The method as defined in Claim 11, further comprising transmitting signals at the second data rate of fs/K over an upstream channel, and receiving other signals at the first data rate of fs over a downstream channel, wherein K is a positive integer.

16. (Original) The method as defined in Claim 11, further comprising removing frequency components above a cut-off frequency of fs(J/2K), wherein fs is the second data rate, K is a positive integer representing the ratio of fs divided by the first data rate, and J is a positive integer that is less than K.

17. (Original) The method as defined in Claim 16, wherein removing frequency components includes removing components above a cut-off frequency of at least one-half of the Nyquist frequency of the transmitted signals.

18. (Original) The method as defined in Claim 11, wherein increasing the data rate of the signal includes upsampling the signal by a factor of J, wherein J is a positive integer that is less than the ratio of the first data rate divided by the second data rate.

19. (Original) The method as defined in Claim 11, wherein estimating the echo signal includes transversally filtering the higher data rate signals and minimizing the number of filter tap weights.

20. (Original) The method as defined in Claim 11, wherein the communication system further comprises an asymmetric digital subscriber loop (ADSL) system.

21. (Currently Amended) A system for canceling echo signals received by a receiver that is configured to operate at a first data rate, the echo signals originating from a transmitter that is configured to transmit signals at a second data rate, the system comprising:

a filter that is configured to substantially remove from the transmitted signals frequency components above a cut-off frequency that is equivalent to at least one-half of the first data rate;

a decimator that is configured to reduce the data rate of the filtered signals from the second data rate to a lower data rate, <u>the lower data rate being determined based at least in part on the frequency portion of the transmitter signals that coincide with bandwidth of the echo signals</u>; and

an echo canceler that is configured to estimate echo signal components based at least in part on the filtered signals at the lower data rate.

22. (Original) The system as defined in Claim 21, further comprising another decimator that is configured to reduce the data rate of the estimated echo signal to match the first data rate of the receiver.

23. (Original) The system as defined in Claim 21, further comprising a subtractor that is configured to subtract the estimated echo signal from the echo signals.

24. (Original) The system as defined in Claim 23, wherein the echo canceler is configured to receive an error signal that is based at least in part on output of the subtractor.

25. (Original) The system as defined in Claim 21, wherein the transmitter is configured to transmit signals at the second data rate of fs over a downstream channel, and the receiver is configured to receive another signal at the first data rate of fs/K over an upstream channel, wherein K is a positive integer.

26. (Original) The system as defined in Claim 21, wherein the filter is configured to remove frequency components above a cut-off frequency of fs(J/2K), and wherein fs is the second data rate, K is a positive integer representing the ratio of fs divided by the first data rate, and J is a positive integer that is less than K.

27. (Original) The system as defined in Claim 21, wherein the filter is configured to remove frequency components above a cut-off frequency of at least one-half of the Nyquist frequency of the transmitted signals.

28. (Original) The system as defined in Claim 21, wherein the decimator is configured to decimate the filtered signals by a factor of K/J, wherein K is a positive integer representing the ratio of the second data rate divided by the first data rate, and J is a positive integer that is less than K.

29. (Original) The system as defined in Claim 21, wherein the echo canceler includes a transversal filter having a minimized number of filter tap weights.

30. (Original) The system as defined in Claim 21, further comprising an asymmetric digital subscriber loop (ADSL) system.

31. (Original) A system for canceling echo signals received by a receiver that is configured to operate at a first data rate, the echo signals resulting from a transmitter that is configured to transmit signals at a second data rate, the system comprising:

a first upsampler that is configured to increase the data rate of the transmitted signals from the second data rate to a higher data rate;

an echo canceler that is configured to estimate an echo signal based at least in part on the upsampled signals; and

a second upsampler that is configured to match the data rate of the estimated echo signal with the first data rate of the receiver.

32. (Original) The system as defined in Claim 31, further comprising a filter that is configured to remove frequency components from the estimated echo signal, the frequency components originating from the second upsampler.

33. (Original) The system as defined in Claim 31, further comprising a subtractor that is configured to subtract the estimated echo signal from the echo signals.

34. (Original) The system as defined in Claim 33, wherein the echo canceler is configured to receive an error signal that is based at least in part on the output of the subtractor.

35. (Original) The system as defined in Claim 31, wherein the transmitter is configured to transmit signals at the second data rate of fs/K over an upstream channel, and the receiver is configured to receive other signals at the first data rate of fs over a downstream channel, wherein K is a positive integer.

36. (Original) The system as defined in Claim 31, further comprising another filter that is configured to remove frequency components above a cut-off frequency of fs(J/2K) from the transmitted signals, wherein fs is the first data rate, K is a positive integer representing the ratio of fs divided by the second data rate, and J is a positive integer that is less than K.

37. (Original) The system as defined in Claim 36, wherein the other filter is configured to remove frequency components above a cut-off frequency of at least one-half of the Nyquist frequency of the transmitted signals.

38. (Original) The system as defined in Claim 31, wherein the first upsampler is configured to increase the data rate of the transmitted signals by a factor of J, and wherein J is a positive integer that is less than the ratio of the first data rate divided by the second data rate.

39. (Original) The system as defined in Claim 31, wherein the echo canceler includes a transversal filter having a minimized number of filter tap weights.

40. (Original) The system as defined in Claim 31, further comprising an asymmetric digital subscriber loop (ADSL) system.

41. (Currently Amended) A system for canceling echo signals originating from a transmitter that is configured to transmit signals at a predetermined data rate, and arriving in a receiver that receives the echo signals, the system comprising:

means for filtering the transmitted signals to substantially remove frequency components above a cut-off frequency that is equivalent to at least one-half of the predetermined data rate;

means for reducing the data rate of the filtered signals from the predetermined data rate to a lower data rate, <u>the lower data rate being determined based at least in part on the frequency portion of the transmitter signals that coincide with bandwidth of the echo signals</u>; and

means for estimating echo signal components based at least in part on the filtered signals.

42. (Original) A system for canceling echo signals arriving in a receiver that receives the echo signals at a first data rate, and originating from a transmitter that is configured to transmit signals at a second data rate, the system comprising:

means for increasing the data rate of the transmitted signals from the second data rate to a higher data rate;

means for estimating echo signal components based at least in part on the higher data rate signals; and

means for matching the data rate of the estimated echo signal with the first data rate of the receiver.